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THREE NEW PHYSIOGRAPHIC TERMS.

CERTAIN phases or types of topography, some of them widespread and all of them distinct, have no appropriate designation. Reference to them, where they have been recognized, has been by tedious circumlocution. Names for three such phases or types of topography are here proposed.

I. TOPOGRAPHIC UNCONFORMITY.

The essential idea underlying this term is a topography on the upper part of a slope, which is out of harmony with the topography on the lower part of the same slope. The slope may be that of a mountain, a hill, or a valley, or it may be the slope of a larger tract, such as a coastal slope. The lack of harmony may be brought about in various ways. The term has to do with the result, not the process by which it was brought about. Two illustrations are added.

1. When a mountain valley, the slopes of which are well dissected by rain and river erosion, is occupied by a thick and effective glacier, the ice is likely to obliterate many of the erosion features of the valley slopes, up to the limit of effective ice-action. The obliteration of the erosion features of the lower slopes is effected partly by erosion and partly by deposition. The result is that the more open, broad, and mature erosion features of the upper slopes are interrupted below at the upper limit of effective ice-action. The more open valleys and ravines above are continued below by the young, narrow, gorge-like drainage channels developed since the glaciation of the valley. These drainage lines of the lower slope are out of harmony with the drainage lines above. In such cases the topography above the limit of effective glaciation is in *unconformity* with that below. Topographic unconformity of this type is common in the western mountains. It may be seen, for example, about Telluride, Colorado, on the slopes above Lake Chelan, and in scores of other places. Fig. 1 shows a portion of the west slope of Lake Chelan near the south end. The topographic unconformity resulting directly from glaciation is somewhat overshadowed by the topographic unconform-

ity which resulted from the development of shore terraces in a lake which stood much higher than the present lake after the ice melted.

2. If a coastal region affected by well-developed valleys is submerged, the lower ends of the valleys become bays. Shore deposits may be made across the mouths of the bays, converting them into lagoons. The lagoons may then be silted up. If the region be subsequently elevated relative to sea-level, the streams coming down the mature valleys above cut new valleys across the new lands recently emerged. The result is that valleys and topography of greater or less maturity above are succeeded coast-ward by valleys and topography which are much younger. Fig. 2, from the coast of California, affords an illustration.

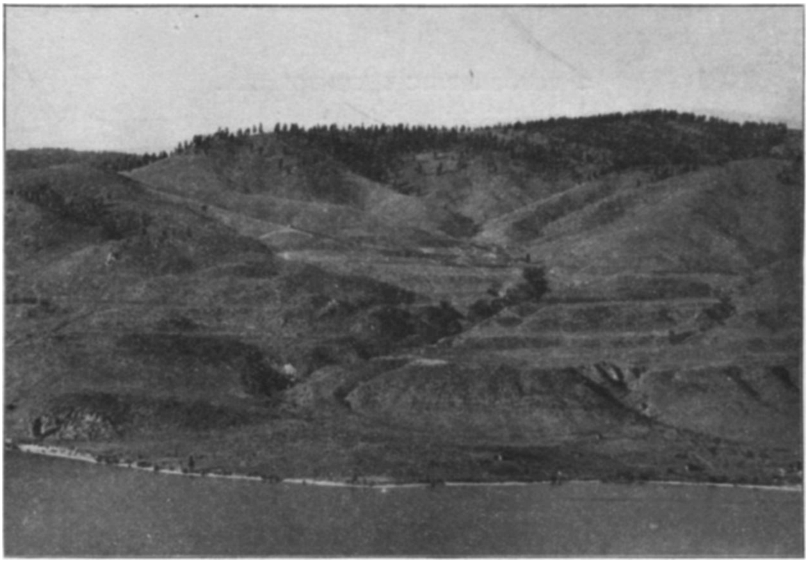

FIG. 1.—The slope of Lake Chelan, showing topographic unconformity.

It is, of course, clear that the same sequence of events may affect a lakeshore, where it is clearly the level of the water which fluctuates. Illustrations of topographic unconformity are perhaps more readily drawn from lakeshores than from seacoasts, for notable changes of water-level are here more common. The borders of Lake Chelan, already referred to, furnish a good illustration, and the shores of

Lake Bonneville furnish others. (See Plates I, IX, XXI, XXII, XXVI, and XXVII, *Monograph* I, U. S. Geological Survey.)

In general, it may be said that any cause which brings about the relations indicated above—namely, greater topographic age on the upper part of a slope, and lesser topographic age on the lower part of the same slope, with a distinct line or belt of separation between the two—develops *topographic unconformity.* If the relations were reversed, so that lesser age on the upper part of a slope was succeeded by greater age below, the two phases of topography being separated by a distinct line or zone, the result would also be a topographic

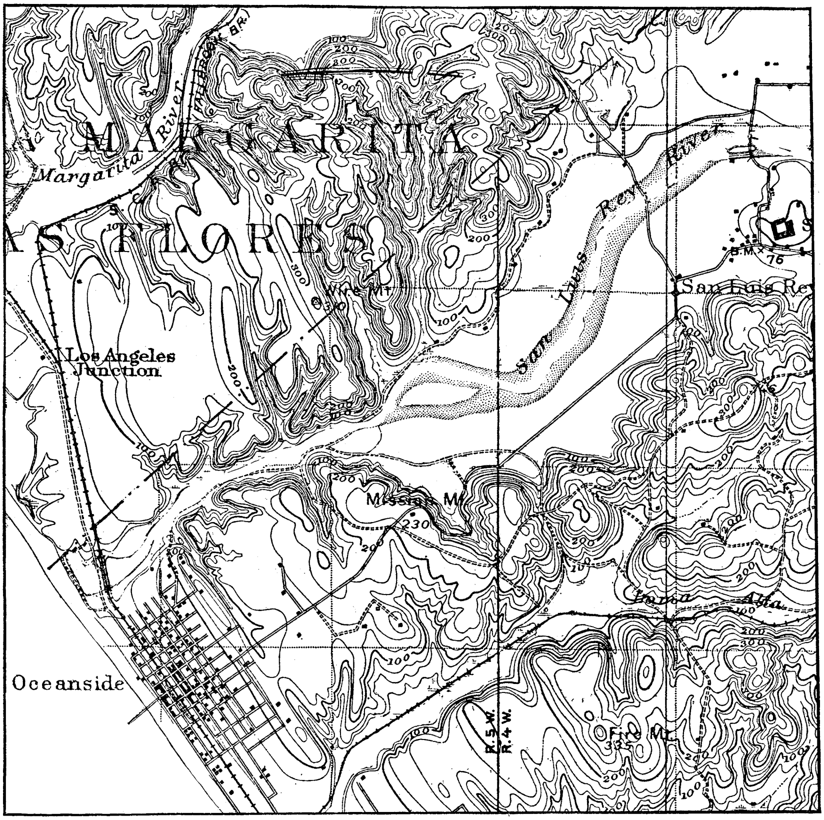

FIG. 2.—Topographic unconformity shown in contours, Oceanside, Cal., quadrangle. Scale, about one and one-fourth miles to the inch.

unconformity. This case is less common than the other, and, on the whole, less striking, since lesser age above and greater age below is the rule. In the normal case, however, there is no distinct line or zone of separation.

Another phase of topographic unconformity will be referred to under "Superimposed Youth."

II. TOPOGRAPHIC ADJUSTMENT.[1]

The term "adjustment," as applied to streams, has been long in use. A stream is said to be adjusted when it flows as little as possible on resistant formations, and as much as possible on weak ones. In general, adjusted streams follow the strike of the formations over which they run, and where they depart from it they are likely to do so by flowing with the dip for short distances. It is proposed to designate the above type of adjustment *structural adjustment*. Structural adjustment has to do with the courses of streams.

There is another type of adjustment, namely, *topographic adjustment*, which has to do with the profiles of streams. One or two illustrations will suffice to make the meaning of the term clear.

1. When a stream has a wide flood-plain, its channel is likely to be now against one bluff, now against the other. This is true of different parts of the valley at the same time, and of the same part at different times. When a stream flows against the bluff on one side for a considerable period of time, the tributaries adjust themselves *topographically* to this position of their main; that is, the lower end of each tributary has the same elevation as its main at the point of union, and the grade of the tributary above the junction is the grade normal to the stream. If now the main stream shifts to the opposite side of its valley, the tributary stream is thrown out of topographic adjustment. Its lower end is too low, for, essentially without grade, it must find its way across the wide flood-plain to the channel on the other side. The result is that the tributary aggrades its lower course until it has a proper gradient out to its main. When this is accomplished, *topographic adjustment* is established.

If now the main stream swings back again to the bluff which it temporarily abandoned, the tributary finds itself again out of topographic adjustment. Its lower end is now too high, and it sets to work to deepen its lower course. When the lower end of its channel is brought to the level of the main at the point of junction, and when its profile above is in harmony with the deepened lower end, the stream is again in topographic adjustment.

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[1] This term has already been published: CHAMBERLIN AND SALISBURY, *Geology: Processes and Their Results.*

2. When falls recede past the debouchures of tributaries, the tributaries are no longer in topographic adjustment to their main.

3. The hanging valleys of glaciated mountain regions, and waterfalls are other cases of lack of topographic adjustment, or of non-adjustment.

Any other course of events which brings about similar results—and they may be brought about in several other ways—may be said to result in the topographic non-adjustment of streams.

III. SUPERIMPOSED YOUTH.

The terms "youth," "maturity," "old age," etc., as applied to rivers, are now in common use. There are certain phases of youth, however, which the term "youth," as commonly used, does not seem to define. In many parts of North America, for example, the topography was mature and the relief great when the ice of the glacial period came on. Partly by erosion and partly by deposition, the ice effected changes in the topography. As the ice retreated, drainage re-established itself on the modified surface.

It often happened in such cases that the old valleys were partially filled, without being obliterated. They were often filled deeply at some points, while they received little drift at others. Basins were developed, and in many cases these basins became the sites of lakes. The drainage which established itself in such regions after the ice melted has not in general had time to obliterate these marks of topographic youth, especially within the area of the last ice-sheet. The streams and valleys themselves have many of the characteristics of youth, such as falls, rapids, lakes at high levels, and, locally, narrow postglacial gorges. All this may be true while the mature topography of the underlying rock is but faintly masked. Considering only the greater features of the topography, there is the appearance of maturity; but when the minor features, such as lakes, ponds, marshes, falls, narrow postglacial gorges, and the peculiar uneroded, or little eroded, topography of the drift are considered, youthful features are seen to abound. In such cases, *youth* has been *superimposed* upon maturity. It is proposed to call this phase of youth

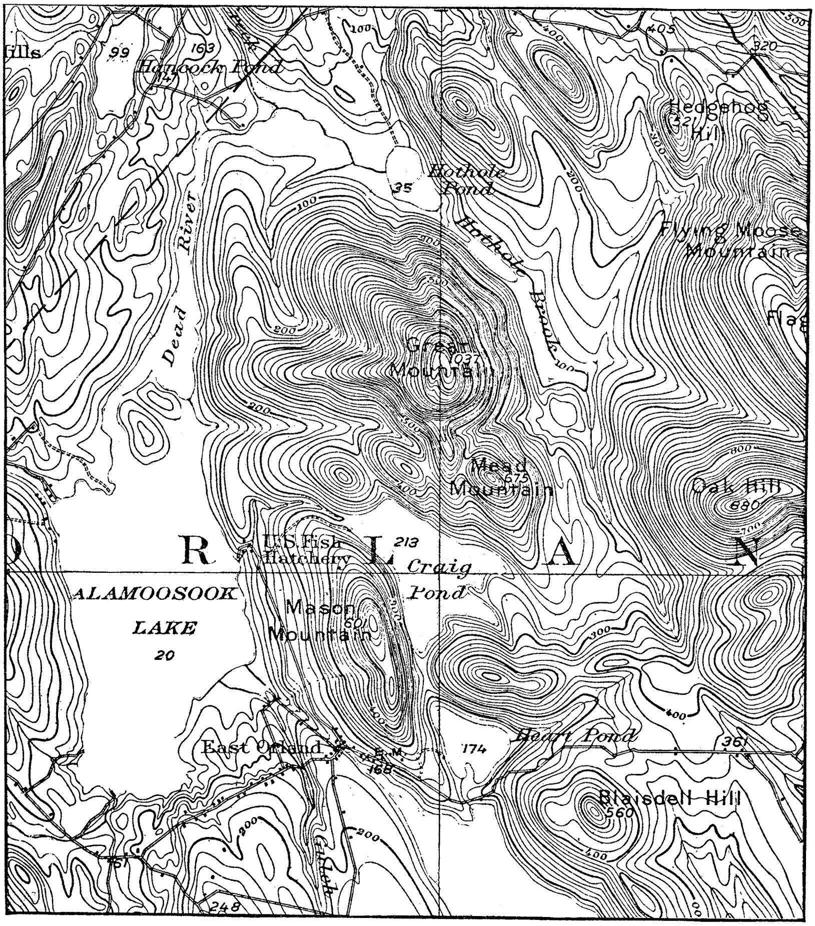

FIG. 3.—Superimposed youth, from the Orland, Me., quadrangle. Scale, about one and one-fourth miles to the inch.

superimposed youth. Fig. 3 furnishes an illustration. Good illustrations abound in the glaciated mountains of the East, and in many areas farther west.

In the foregoing case, youth was superimposed on maturity.

But the type of youth here referred to might be superimposed on a topography which was old, or on a topography which was young. Thus, when the upper, but not the lower, portion of a young mountain valley is severely glaciated, a topographic change is effected. The wide, open, U-shaped or cirque-like upper part of the valley which was glaciated, is often continuous below with a narrow valley of a very different type. In spite of the fact that the glaciated part of the valley is wide open, it possesses distinctly youthful characteristics. Even though the valley was youthful before glaciation, its youth has now assumed another phase. Here youth is superimposed on youth. Examples of this phase of superimposed youth abound in nearly every mountain range of the West where there were glaciers during the last epoch.

In the cases cited, the superimposition of youth has resulted from glaciation. Should it become desirable to distinguish between the youthfulness superimposed by different means, the type of superimposition cited above might be called *glacially superimposed youth*.

Between the *superimposed youth* of the upper glaciated part of the valleys cited in the above illustration, and the normal youth of the parts below, there are (1) a *topographic unconformity* and, (2) a lack of *topographic adjustment.*

THE NEED OF DISCRIMINATING TYPES OF YOUTH.

There are various types of topographic youth which need to be discriminated. Take, for example, the types of youth illustrated by the region about Fargo, N. D. (Fig. 4), and that shown along the shore of Lake Michigan just north of Chicago (Fig. 5). The former region has often been cited, and properly, as an illustration of topographic youth, but it hardly represents normal youth.

The different phases of youth shown by these two areas are always confusing to students at the stage when they are learning to interpret topographic maps. In the one case, young valleys are in process of normal development, and those which continue to grow should, in the course of time, acquire permanent streams. In the other, the surface came into possession of a well-developed stream somewhat suddenly, after the retreat of the ice. The meandering course of the river, in the one case (Fig. 4), is often mistaken for a mark of age.

Special names for the types of youth illustrated by these two

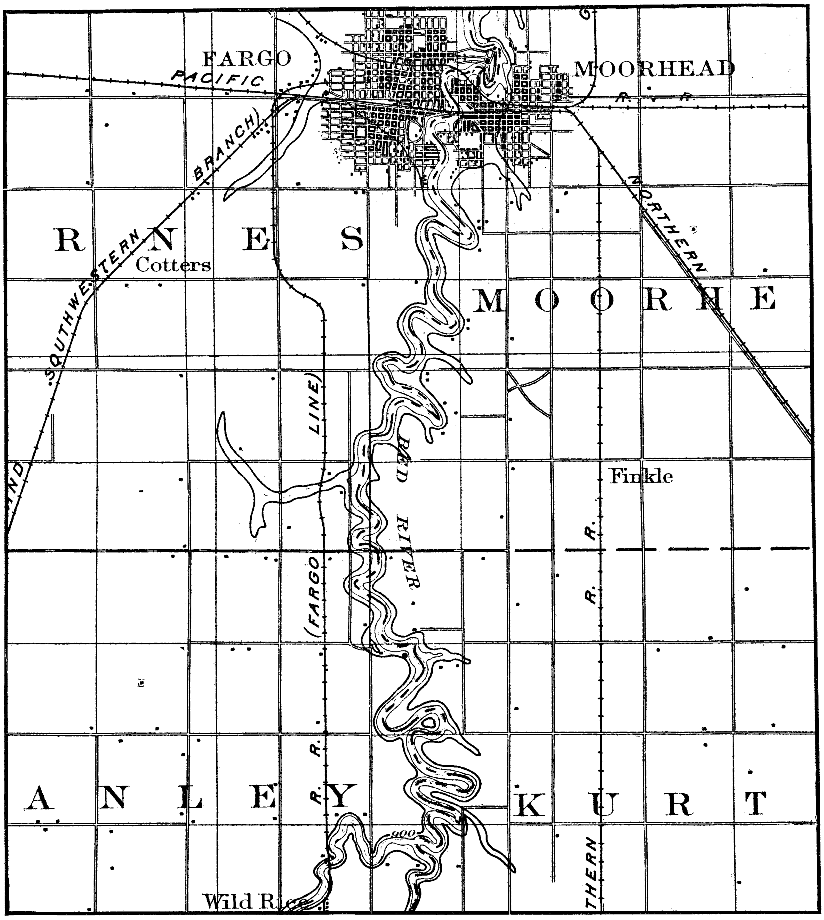

FIG. 4.—A type of youthful topography, from the Fargo, N. D., to Minnesota quadrangle. Scale, about two miles to the inch.

areas would be useful. If the type of topography represented in Fig. 5 be regarded as that of normal youth, that shown in Fig. 4 should be designated by some qualifying adjective. No fitting

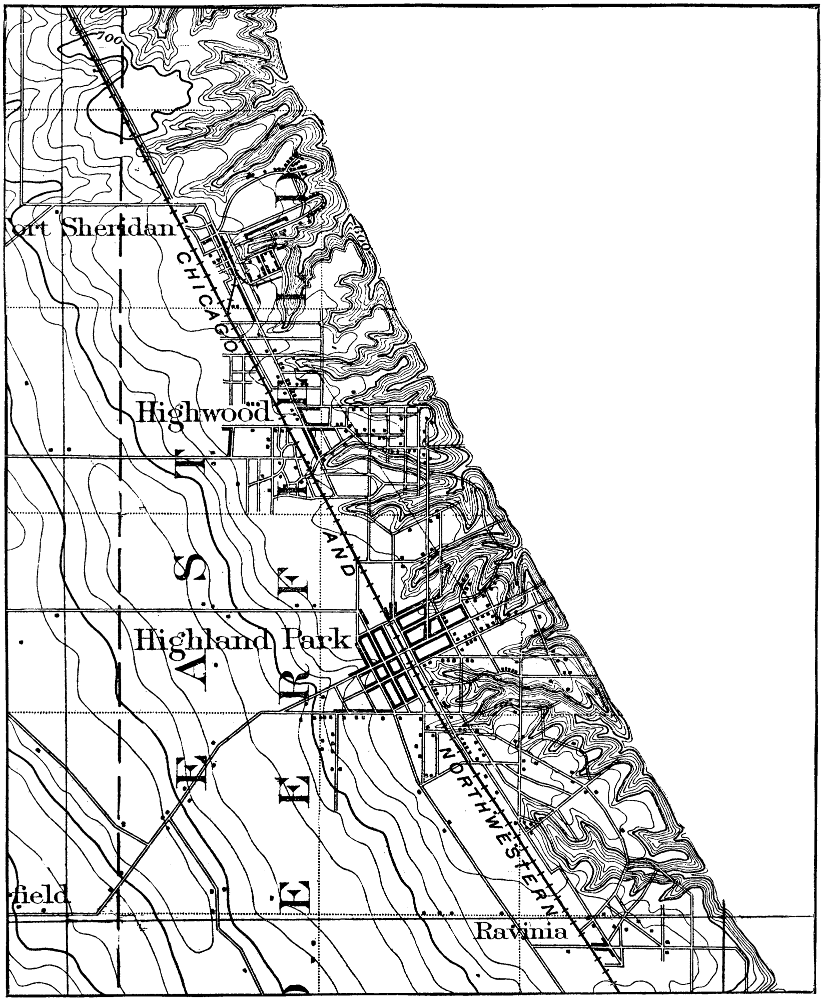

FIG. 5.—A second type of youthful topography, from the Highwood, Ill., quadrangle. Scale, about a mile to the inch.

term has suggested itself. *Superimposed youth* hardly seems to be appropriate, for there is here no evidence, which the student who is not yet a master of topographic maps may recognize, that the stream has been superimposed.

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